SCIENCE

FRIDAY, APRIL 20, 1888.

HUNDREDS OF REPORTS have been received at the Hydrographic Office of the Navy Department from vessels that experienced the storm of March 11–15, more than seventy of them from vessels that were immediately off the coast of the United States. An interesting feature of these latter is the descriptions of the use of oil to calm the waves. More than a dozen captains and sailing-masters caught in the storm when it was at its worst say that they believe that their vessels were saved by it. The sailing-master of the yacht 'Iroquois' says that the furious waves would be coming down upon them with an immense comb, threatening to swamp them; but, when it encountered a patch of oil no larger than a dining-room table, its top would be rounded, and there would not be even a wind-ripple upon it, and the yacht would bob over it like a gull. The reports of the storm have brought no new facts in regard to the use of oil to still the waves, but they confirm the opinions heretofore held, and will undoubtedly lead to its more frequent employment. The great service which the Hydrographic Office has rendered to navigation in this regard is now recognized in all maritime countries. Only lately, Capt. W. J. L. Wharton, R.N., hydrographer to the British Admiralty, in *Nature*, began an article by saying that the employment of oil by the ships of all countries was due to the efforts of the United States Hydrographic Office in forcing the subject upon the attention of navigators. Similar testimony has been given by high officers of the French Navy in recent publications.

THE PHILADELPHIA *Press*, in commenting upon some recent remarks of *Science* touching the wastefulness caused by the delays in printing scientific reports of the government, remarks that good editors are needed in Washington as much as more printers and better management of the Government Printing-Office. This is true, and the remark is applicable to all other bureaus and departments as well as those engaged in scientific work. Scarcely a volume is published by the government that would not be greatly improved by condensation. Examples are hardly necessary for those who are in the habit of looking over government publications, but one or two may be given in illustration. Congress has just ordered an extra edition of twenty-five thousand copies of a report on 'Cattle and Dairy Farming,' made by the consuls of the United States abroad, of which the original edition has been exhausted, and for which there has been much call by the cattle-raisers and dairy-farmers of the United States. It comprises two volumes, together containing 855 pages of letterpress, besides 369 full-page lithographic engravings. The book contains a large amount of very valuable information that can be obtained nowhere else; but, if it had been edited only to the extent of cutting out nothing but duplications, the dimensions of the book might have been reduced one-half, and its value greatly increased. In many instances several consuls in the same country went over the same ground, and sometimes obtained their information from the same sources. The best of these reports ought to have been selected for publication in full, and only the additional matter contained in the others added in carefully selected extracts. But instead of doing this, the State Department put the reports and enclosures all in, in full, and thus made a book that is likely to frighten a farmer by its very size. Another example of enormous waste in printing, to say nothing of the doubtful expediency of preparing the matter, is to be seen in a 'Report upon an Examination of Wools and other Animals,' by Dr. McMurtrie, prepared under the direction of the commissioner of agriculture. It is a quarto book of more than 600 pages, about 100 of which are filled with letterpress and illustrations, and 500 with solid tables of figures. One of these, filling 32 pages, is a 'Table for Reduction of Centimillimetres to Fractions of an Inch.' No printer will have to be told how expensive this rule-and-figure work, with its 21 columns to a page, is. Another, filling 102 pages with solid figures, gives the 'Results of Actual Measurements of Length, Crimp, and Fineness, with Recapitulations and Reductions.' And so on for 500 pages. Now, if it was necessary to make all these measurements, it certainly was not necessary to print them. The results of them are set forth in the body of the report, and these are all practical men want. If a scientific man desired to see all the figures made to obtain these results, he could go to the files of the Agricultural Department and examine them there. An octavo volume of 200 pages would have contained all that it was necessary to print, and would not have cost, with illustrations, more than one-fourth as much. The government needs an editor.

THE WORK upon the marble terrace which is to surround the Capitol at Washington on three sides is nearly completed, and the effect of it upon the architectural appearance of the building can now be seen. From any point on Pennsylvania Avenue between the Treasury Department and the western entrance to the Capitol grounds, the effect is unquestionably pleasing. The terrace will appear as though it was the foundation of the building, thus making it seem to be decidedly higher, and relieving it of that 'squatty' appearance which has always offended the eyes of those who have an appreciation of proper proportions in a grand structure. Viewed from a distant point either on the north, south, or west, therefore, this marble terrace seems to be an architectural success. But, as soon as one enters the west Capitol park and approaches the building, he discovers that this so-called improvement, expensive as it has been, is a blemish rather than an embellishment of the Capitol. Long before reaching the foot of the grand stairway, the marble terrace not only ceases to appear as a part of the building, but hides a part of its beautiful front. At the Marshall statue the upper edge of it is projected against the marble columns of the two wings of the Capitol halfway from their bases to their capitals, and from many parts of the grounds on the west they greatly disfigure the noble structure. It is just as important that the proportions of the Capitol shall appear to be correct when viewed from a point that is near as from one that is removed; but the architect seems to have supposed, that, when a person has once entered the grounds from the west, he will be so much impressed with the grand marble stairway that he will not raise his eyes to the building to which they lead.

THE PLAN OF ESTABLISHING a zoölogical garden in Boston, which has been pending for twenty-one years, seems to lead at last to practical results. The council of the Boston Society of Natural History has taken the matter in hand. It gained the co-operation of the park commissioners, who offered two separate sites for the garden. The society proposes to make the enterprise thoroughly educational. In view of the climate of New England, no attempt will be made to make the garden of so general a nature as they are made in Europe. It will be rather an effort to show specimens of American animals, especially those of New England. Finally it was resolved to make an attempt to raise a sum of $200,000, and then to proceed with the establishment of a garden and aquaria. The en-

ergetic efforts of the committee will undoubtedly succeed in arousing a general interest in the matter and in raising the necessary funds. The educational value of a garden like the one proposed can hardly be overestimated, as it affords to the inhabitants of the city those advantages which, as a rule, only those living in the country enjoy.

THE AMERICAN PHILOSOPHICAL SOCIETY has paid considerable attention to the subject of a universal language; and on Oct. 21, 1887, a committee was appointed, of which Prof. D. G. Brinton was chairman, to examine into the scientific value of Volapük. The committee recently presented its report, and the society adopted the following resolution: "That the president of the American Philosophical Society be requested to address a letter to all learned bodies with which this society is in official relations, and to such other societies and individuals as he may deem proper, asking their co-operation in perfecting a language for learned and commercial purposes, based on the Aryan vocabulary and grammar in their simplest forms; and to that end proposing an International Congress, the first meeting of which shall be held in London or Paris." The introductory remarks to the report of the committee, referring to the desirability of an international scientific terminology, will be approved by all scientists; but many will rather join Max Müller's appeal to the learned writers of the world to express themselves in English, German, French, Spanish, Italian, or Latin, than support the plan of establishing a new universal language. The proposals of the committee are founded on the process of formation of jargons. Grammatical forms are eliminated, and the order of words determines the meaning of the sentence. The phonetics are to be simple, and the vocabulary based on the vocabulary which is common to the leading Aryan tongues. As Volapük and other universal languages are not formed according to these principles, the committee considers them as not apt to meet the requirements of international intercourse. All this may be true, but it would seem to us that scientists, even if successful in the attempt at forming an artificial language which would be as well adapted for thinking as for writing and speaking, would increase the amount of necessary work instead of diminishing it. Before the era of nationalities, as we may well designate our time, English, German, French, and Spanish were almost exclusively used in scientific publications of any importance. The same feeling that prompted writers to use their own language, however few the men speaking it may be, will prevent the general adoption of a universal language; and when this feeling has subsided, those few European languages will again become the means of scientific intercourse. And how should we make use of the treasures contained in the literature of the past, or in popular writing, without learning these languages? We believe that these difficulties, even aside from that of making a satisfactory language, will prevent the scheme of a universal language being successful.

YUKON EXPEDITION, 1887.

WE noticed several times the progress of the Yukon expedition undertaken by the Canadian Government in 1887. The present number of *Science* is accompanied by a map showing the results of this important expedition. The map is a reduction of a large-scale map published by the Department of the Interior of Canada, a number of corrections being added by Dr. Dawson. The coast-line is founded upon the charts of the Coast Survey. While the greater part of the topography of the interior is the result of last year's expedition, a few older explorations were available for constructing the map. The lower part of the Stikine River was surveyed in 1877 by J. Hunter. The traverse from Telegraph Creek down the Hotalinqua River, to latitude 60° north, was made by the Telegraph Exploration in 1867. Schwatka's maps were used for constructing the lower part of Pelly River, while Chilkat River is founded on Dr. A. Krause's surveys in 1882.

The recent expedition was undertaken in consequence of the necessity of ascertaining the nature and extent of the developments of placer gold-mining, which of late years has attracted an increasing number of miners into that part of the North-west Territories lying between British Columbia and Alaska. We reported in No. 243 of *Science* on the progress of Dr. Dawson's expedition up to the 29th of July. Mr. William Ogilvie had reached the lower part of Pelly River by a different route. He had started from Chilkoot Inlet, and reached the summit of Chilkoot Pass on June 8. On June 27, after considerable difficulty occasioned by stormy weather, the first lake was reached. Mr. Ogilvie experienced considerable difficulty in carrying his instrumental survey across the mountains. He says in his report to Captain Deville, "Beginning from the summit of Chilkoot Pass, we descend almost one-third of a mile to Crater Lake, the fall in that distance being by barometer 367 feet. At four miles and a half from the summit, Mountain Lake, which is about a mile and a half in length, is reached, the fall in this distance being about 575 feet. At this point the first trees on the north-east side of the summit are seen, but they are of no importance, being small and of stunted growth." Lake Lindeman was found to be 1,237 feet below Chilkoot Pass. The party then crossed Lake Bennett and Lake Marsh, and began their descent of the Lewes River. "At 125 miles from salt water, the cañon is reached. At this point the river flows through a fissure in a barrier of basaltic rocks which intersects its course. The cañon proper is about five-eighths of a mile long and about 100 feet wide, with perpendicular walls from 60 to 80 feet high. The current through it is swift and the water rough; but with a fairly large boat, the only risk in running through it would be from contact with the sides, in which case one would be certain to come to grief. The passage through it is made in from three to four minutes. The cañon and its rapids are altogether two miles and three-quarters long. The last rapid, which is three-eighths of a mile in length, is a bad one, and we had to portage every thing round it, and let our boat down with ropes from the shore. This rapid is called by the miners the 'White Horse,' from the fact that nearly all the water is white with foam. Several parties have run through the rapid on rafts, and one or two in boats, but few want to repeat the trip." In proceeding farther down the river, the travellers passed Big Salmon River. Looking up its valley, a distant view was had of many mountain-peaks covered with snow, the presence of which in summer is proof of a considerable altitude. Ogilvie found that the upper part of the river was almost deserted by the miners, who have gone to Forty-Mile Creek, where considerable quantities of gold have been found.

Dr. Dawson, who had reached the Pelly River by way of the Stikine and Frances Lakes, describes the latter part of his journey as follows: "Our Indians, who had for a long time been very uneasy because of their distance from the coast and the unknown character of the country into which they had been taken, were now paid off, and, to their great delight, allowed to turn back. As a dangerous rapid was reported to exist on the upper part of the Pelly, it was decided to construct a canvas canoe in preference to building a boat, which it might prove impossible to portage past the rapid. Having completed the canoe, we descended the Pelly, making a portage of half a mile past Hoole's Rapid, and reached the confluence of the Lewes branch of the Pelly on the 11th of August. We had now reached the line of route which is used by the miners, and expected to find at the mouth of the Lewes a memorandum from Mr. Ogilvie, from whom we had separated in May. As we could not find any such memorandum, and as Mr. Ogilvie had not been seen on the lower river by a party of miners whom we met here on their way up the Lewes, we were forced to conclude that he had not yet reached this point. The same party informed us that few miners were during the summer on the Stewart River, where most of the work had been carried on in 1886, but that in consequence of the discovery of 'coarse' gold on Forty-Mile Creek, about 120 miles farther down the river, all had gone there, and that Harper's trading-post, where I had hoped to be able to get an additional supply of provisions should we fail to connect with Mr. Ogilvie, had also been moved from the mouth of the Stewart to Forty-Mile Creek. From the place where we now were, we still had a journey of over 400 miles to the coast, with the swift waters of the Lewes to contend against for most of the distance. If, therefore, it should have become necessary to go down stream 220 miles to Forty-Mile Creek for provisions, so much would have


144
142
140
138
136
134
66
64
ALASKA
NORTH WEST TERRITORIES
BELLE ISLE
John's Village
BOUNDARY BUTTE
PORTY MILE CR.
COSE HILL R.
Forty Mile
FT. RELIANCE
DEER R.
FORDLER R.
INDIAN CAMP
AYONIES R.
STEWART RIVER
of Campbell
BEAVER RIVER
REID LAKES
GAUCHES LAKES
UPPER RAMPARTS
PELLY RIVER
Indian Vil.
FT. SELKIRK
(ruins)
KALZAS LAKE
MACMILLAN RIVER
INTERNATIONAL BOUNDARY
TANANAH RIVER
WHITE RIVER
LEWES RIVER
Rapids
Rink Rapids (Schwatka)
Five Fingers (Miners)
Rapids
Nordenskiold R.
Little Salmon R. (Daly R.)
Big Salmon R. (D'Abbadie R.)
ULEN LAKE
MT. ST. ELIAS 19,500'
MT. COOK 16,000'
MT. VANCOUVER 13,100'
ALTSEK RIVER
LAKE LABARGE
Mountain Hills
500 to 600'
TESKIN-TOO OR


NORTH WEST TERRITORIES
BRITISH COLUMBIA
PACIFIC OCEAN
64
62
60
FT. SELKIRK (ruins)
LEWES RIVER
MACMILLAN RIVER
WHITE RIVER
Rapids
Rink Rapids (Schwatka)
Five Fingers (Miners)
Nordenskiold R.
Little Salmon R. (Daly R.)
Eagle's Nest
Big Salmon R. (D'Abbadie R.)
TES-ZIN-TOO OR NEWBERRY RIVER (SCHWATKA)
HOOTALINQUA RIVER
LAKE LABARGE
Limestone Hills 500 to 600'
Hoole's Rapids
PELLY LAKES
FINLAYSON LAKE
CAMPBELL'S PORTAGE
FINLAYSON RIVER
FRANCES LAKE
FORT FRANCES (ruins)
Moose L.
Upper Cañon and Rapids
FRANCES RIVER
LIARD RIVER
Cañon
NORTHERN BOUNDARY OF BRITISH COLUMBIA
Sylvester's Cache
Cañon
Lower Post
To the Mackenzie
Lil. Rap.
Trout Cr.
Quartz Cr.
MCDAMES CR.
S. Fork
LEWES RIVER
White Horse Rapids (Head of Steamboat Navigation)
QUIET LAKE
TES-LIN OR A-KLENE L.
HOTALINQUA R. of Telegraph Survey
Teslin Lake
NORTH FORK
TAKU
Tahon Lake
Vatonee L.
Disella L.
TAKU RIVER
Lake Nares
LINDEMAN
CHILCOOT, TAYA OR PERRIER PASS
MT. CLEVELAND 6,000
MT. CARMACK 6,840
Cañon L.
Mountain L.
Crater L.
Head of Canoe Navigation
MT. EMMONS 4,700
Indian Vil.
MT. NEWBERRY 5,000
Taya Inlet
CHILKAT PASS
CHILKAT R.
Chilkat L.
Pyramid I.
Cannery
Seduction Pt.
Sullivan
Sullivan Rock
CHILCOOT MTS.
Berners Bay
Pt. Bridget
LIONS HEAD
WHITE MTS.
Pt. Whidbey
Little I.
Rast I.
Lincoln I.
Retreat
Gastineau Cha.
JUNEAU CITY
ALTSEK RIVER
MT. ST. ELIAS 19,500'
MT. COOK 16,000'
MT. VANCOUVER 13,100'
OCEAN CAPE
Dry Bay
CAPE FAIRWEATHER
MT. FAIRWEATHER 15,500'
LITUYA MT. 10,000'
Lituya Bay
MT. CRILLON 15,900'
MT. DAGOLET
MT. LA PEROUSE 11,300'
JOY PT.
ASTROLABE PT.
CAPE SPENCER
Cross Sound
PT. BINGHAM
POINT SURCY
Glacier Bay

Map of the Upper Yukon River.

(SCALE 1 : 3.000.000.)

SCIENCE, April 20, 1888. *No.* 272.


144
142
140
138
136
134
62
60
ALASKA
NORTH WEST TERRITORIES
BELLE ISLE
John's Village
BOUNDARY BUTTE
PORTY MILE CR.
CONE HILL R.
Forty Mile
FT. RELIANCE
DEER R.
FORGIER R.
INDIAN CAMP
AYONIES R.
STEWART RIVER
of Campbell
BEAVER RIVER
REID LAKES
GAUCHES LAKES
UPPER RAMPARTS
PELLY RIVER
INTERNATIONAL BOUNDARY
TANANAH RIVER
Indian VIL.
FT. SELKIRK
(ruins)
KALZAS LAKE
MACMILLAN RIVER
WHITE RIVER
LEWES RIVER
Rapids
Rink Rapids (Selwatka)
Five Fingers (Miners)
Nordenskiold R.
Rapids
Little Salmon R. (Day R.)
Eagle's View
CLAY LEWES
Big Salmon R. (D'Abbadie R.)
MT. ST. ELIAS 19,500'
MT. COOK 16,000'
MT. VANCOUVER 13,100'
PT. MANBY
ALTSEK RIVER
LAKE LABERGE
Limestone Hills
500 to 600'
HOOTALINQUA
TES-SIN-TOO OR WINDY R.


NORTH WEST TERRITORIES
BRITISH COLUMBIA
PACIFIC OCEAN
MACMILLAN RIVER
WHITE RIVER
LEWES RIVER
FT. SELKIRK (ruins)
Rink Rapids (Schwatka)
Five Fingers (Miners)
Nordenskiold R.
Rapids
Little Salmon R. (Daly R.)
Eagle's Nest
Big Salmon R. (D'Abbadie R.)
TES-ZIN-TOO OR NEWBERRY RIVER (SCHWATKA)
HOOTALINQUA RIVER
LAKE LABARGE
Limestone Hills 500 to 600'
White Horse Rapids (Head of Steamboat Navigation)
QUIET LAKE
TES LIN OR A-KLENE L.
Hoole's Rapids
PELLY LAKE
FINLAYSON LAKE
FINLAYSON RIVER
CAMPBELL'S PORTAGE
FRANCES LAKE
FORT FRANCES (ruins)
Moose L.
Upper Canon and Rapids
LIARD RIVER
Cañon
NORTHERN BOUNDARY OF BRITISH COLUMBIA
Sylvester's Cache
To the Mackenzie
Taton Lake
HOTALINQUA R. of Telegraph Survey
TAKU RIVER
CHILKAT PASS
CHILKAT R.
Chilkat L.
Lake Nares
Head of Canoe Navigation
Cañon L.
Mountain L.
Crater L.
Indian Village
CHILKOOT, TAIYA OR PERRIERS PASS
MT. CLEVELAND
MT. CARMACK
CHILCOOT MTS.
WHITE MTS.
Seduction Pt.
Sullivan I.
Berners Bay
Pt. Bridget
LIONS HEAD
Lincoln I.
Gastineaux Cha.
Cross Sound
CAPE SPENCER
PT. BINGHAM
POINT DUROY
ASTROLABE PT.
ICY PT.
MT. LA PEROUSE 11,300'
MT. DAGOLET
MT. CRILLON 15,900'
LITUYA MT. 10,000'
MT. FAIRWEATHER 15,500'
Lituya Bay
CAPE FAIRWEATHER
Dry Bay
ALTSEK RIVER
OCEAN CAPE
PT. MANBY
Icy Bay
MT. ST. ELIAS 19,500'
MT. COOK 16,000'
MT. VANCOUVER 13,100'
60
58

Map of the Upper Yukon River.

(SCALE 1 : 3,000,000.)

SCIENCE, April 20, 1888.

been added to our up-stream journey that it would become doubtful whether we should be able to afford time for geological work on the Lewes, and reach the coast before the smaller lakes near the mountains were frozen over. I therefore decided to set about the building of another boat, suitable for the ascent of the Lewes, and on the second day after we had begun work Mr. Ogilvie very opportunely appeared. After having completed our boat and obtained Mr. Ogilvie's preliminary report and survey sheets, together with the necessary provisions, we began the ascent of the Lewes, from the head waters of which we crossed the mountains by the Chilkoot Pass, and reached the coast at the head of Lynn Canal on the 20th of September. I am happy to be able to add that the entire expedition was carried out without any serious accident or loss, notwithstanding the difficult nature of the country, and that, though circumstantial reports were heard in the spring, of trouble between the miners and Indians on the Yukon, these proved to be entirely groundless."

Mr. Ogilvie proceeded down the Pelly River, and is now wintering in the vicinity of Belle Isle. It was proposed to make astronomical observations corresponding to those of Mr. Ogilvie near the point of intersection of the Yukon and 141st meridian at two places, — Kamloops and Ottawa. Unfortunately the corresponding observations could not be carried out, and the value of Mr. Ogilvie's astronomical work is therefore problematical. This spring he will start for the mouth of the Mackenzie by way of the Porcupine River and Fort Macpherson, and ascend the Mackenzie to Fort Chipewayan, connecting with his own survey of the Peace and Athabasca Rivers.

THE GEOLOGICAL OBSERVATIONS OF THE YUKON EXPEDITION, 1887.

THE routes to be followed by the expedition were selected with the purpose of obtaining as much information of a geographical, geological, and general character as possible of the great tract of country included in the extreme northern part of British Columbia, and to the north of the 60th parallel (which forms the boundary-line of that province), between the Rocky Mountains proper on the east, and the borders of Alaska on the west. The greater part of this vast region is drained by several large tributaries of the Yukon River, but these interlock to the south with tributaries of the Stikine and with branches of the Liard, a feeder of the Mackenzie.

The results obtained will form the subject of a detailed report of the Geological Survey of Canada, but for the preparation of this some time is yet required; and Mr. Ogilvie of the Dominion Lands Branch, and Mr. McConnell of the Geological Survey, are still in the field for the purpose of continuing surveys and explorations next summer. Meanwhile the following notes, bearing particularly on the principal geological features of scientific importance, may prove of interest.

In 1879 a geological traverse was made by the writer, of the entire width of the Cordillera region, by the line of the Skeena and Peace Rivers (*Report of Progress of the Geological Survey of Canada*, 1879–80); but this had, so far, remained the most northern line of geological examination across the wide mountain-belt of the west coast of the continent. The work of the past summer included a similar traverse of the same belt by the Stikine, Dease, and Liard Rivers, at a minimum distance of two hundred miles north of the last, and extended by the last-named river completely through the Rocky Mountains, to the great valley of the Mackenzie. The latter part of the traverse was, however, undertaken by Mr. McConnell, and his observations are not yet available.

To the north of this cross-section the exploration extended in the Yukon basin to the mouth of the Lewes River, near the 63d parallel. The actual line of travel and survey followed the Liard from its junction with the Dease northward to its sources, crossed the height of land to the Pelly near its head waters, followed that river down to the mouth of the Lewes, ascended the Lewes southward to its head, and finally, traversing the coast mountains by the Chilkoot Pass, reached the head of Lynn Channel.

The entire region thus examined may be described as mountainous in general character, though comprising also wide areas of hilly or rolling country, and many important flat-bottomed river-valleys. It declines as a whole gradually to the north-westward from heights of 2,730 feet at the Stikine-Dease watershed, and 3,150 feet at the height of land between the Liard and Pelly, to 1,550 feet at the confluence of the Lewes and Pelly. The close-set mountains forming the coast ranges on one hand, and on the other the serried peaks at the base of which Frances, Finlayson, and Pelly Lakes lie, and which represent the western tier of the Rocky Mountains, are here the principal mountain axes. A third important intermediate range, which it is proposed to name the Cassiar Range, is, however, cut through by the Dease River immediately to the east of Dease Lake. This appears to be continuous in a north-westward direction to the Pelly, after reaching which it assumes a more westward course, and with decreasing altitude follows parallel to the river, which it eventually crosses, near the mouth of the Lewes, in the form of low ranges of hills. The trend of the subsidiary and less continuous ranges to the west of the Rocky Mountains proper, as well as the prevailing strike of the rocks, partake in a similar general change in direction, wheeling westward in the north in approximate conformity with the outline of the Pacific coast.

The rocks throughout the entire region above outlined present close analogies to those already investigated in the southern portions of British Columbia, thus confirming previous statements with respect to the great general similarity, in a north-westerly and south-easterly direction, of the peculiar geological features of the Cordillera belt. The coast mountains where crossed by the Stikine, and again still farther north in the line of the Chilkoot Pass, consist for the most part of granitoid rocks, which are generally rich in hornblende and triclinic felspars. With these are occasionally included belts of crystalline schists, micaceous or hornblendic, the rocks as a whole resembling those of which details are given in my last report on Vancouver Island (*Annual Report of the Geological Survey*, 1886). It may be said, in fact, that the composition and structure of the coast ranges is practically identical wherever they have been examined, from the Fraser River to the head of Lynn Channel, — a length of nearly nine hundred miles.

To the east of these ranges, the country to and including the Rocky Mountains proper is chiefly characterized by the occurrence and wide distribution of paleozoic rocks, which often closely resemble those provisionally named the Câche Creek Series in southern British Columbia. They include limestones, quartzites, argillites, slates, and schists, with a notable proportion of agglomerates and other materials of volcanic origin, and are all pretty thoroughly altered and hardened and considerably flexed. Near Dease Lake, and again on the Pelly almost on the same line of strike, important beds of serpentine occur, and the associated rocks in these and many other places are preponderantly schistose and slaty, running through a number of varieties, but closely resembling the schistose and slaty rocks of Cariboo, and other gold-bearing districts to the south, and here also yielding gold.

These paleozoic rocks are interrupted by granitic areas, which generally rise in the form of ridges or mountain elevations, and were in some places observed to be flanked by more or less considerable occurrences of crystalline schists, which appear to be more highly altered portions of the paleozoic. The most important of these inland granitic ranges is that previously referred to as the Cassiar Range. Granitic mountains also, however, occur in the range to the east of Frances Lake, and elsewhere.

Fossils are by no means abundant in the paleozoic rocks; but a small collection of graptolites was obtained on the Dease, which has been submitted to Professor Lapworth, and by him pronounced to be of middle ordovician age, six species being recognized. This is, no doubt, the farthest north-western occurrence of a graptolitic fauna so far noted on the continent. Carboniferous fossils, notably *Fusulina* and *Loftusia Columbiana*, were obtained from limestones in the Liard basin, and again on Tahko or Tagish Lake near the head of the Lewes River. It is probable, however, that rocks ranging from the Cambrian to the top of the paleozoic, and possibly also including the triassic (Vancouver or Nicola Series), may be embraced in this great preponderantly paleozoic area.

Strata which are probably of cretaceous age occur on the Stikine in limited basins immediately to the east of the coast mountains; and rocks holding middle or lower cretaceous marine fossils have a considerable development on the Lewes, where they are associated

with plant-bearing beds of the horizon (as determined by Sir W. Dawson) of the Laramie, or so-called miocene of the Mackenzie River and Alaskan coast. A few fossil plants, which are probably of cretaceous age, were also found at one place on the Pelly.

The miocene proper is represented in the upper Liard valley by soft stratified rocks associated with basalts; and basaltic flows of limited extent, and probably of the same age, occur on the Pelly, at the confluence of that river with the Lewes, on the latter river at the Cañon, and again in the Stikine valley east of the coast mountains. There is not, however, in the entire region examined, any wide basaltic plateau.

Some features of special scientific importance occur in connection with the superficial deposits and the evidences of glacial action, but these cannot be more than mentioned in this brief note. It may be stated, however, that true bowlder-clay is frequently seen in the river-sections, and generally passes up into and is covered by important white or gray silty deposits, resembling those of the Nechacco basin in British Columbia, and of the Peace River region to the east of the Rocky Mountains. These later-glacial silts are particularly widespread in the Upper Yukon basin. Terraces are generally conspicuous features in the landscape, and extend even to the higher parts of the district, while water-worn and travelled stones were found to occur at a height of at least 4,300 feet on an isolated mountain near the watershed between the Liard and Pelly Rivers. In the Lewes and Pelly valleys, traces of the movement of heavy glacier-ice in northward or north-westward directions were observed in a number of places, the grooving and furrowing being equally well marked at the water-level and across the summits of hills several hundred feet higher. The facts are such as to lead to the belief that a more or less completely confluent glacier-mass moved in a general north-westerly direction from the mountainous district south of the southern sources of the Yukon, toward the less elevated country which borders the lower river within the limits of Alaska. This observation, taken in connection with the evidence of the former northward movement of glacier-ice in the Arctic regions to the east of the Mackenzie (*Annual Report of the Geological Survey*, 1886, p. 56 R), appears to have very important bearings on theories of general glaciation.

The discovery of small rounded bowlders or pebbles of jade (nephrite) on the upper part of the Lewes River may be mentioned as of interest. Though not actually observed in place, the material is evidently derived from the altered volcanic rocks, probably of paleozoic age, which are abundant in the district. The theory that the jade used by the coast tribes for the manufacture of implements was imported by them from Asia, if still held by any, can scarcely any longer be maintained as tenable.

A second minor point of interest brought to light in connection with the expedition is the existence of a very wide-spread deposit of volcanic ash in the Upper Yukon basin. This generally occurs beneath the soil, but is distinctly newer than the silts or latest glacial deposits. It forms a layer which is seldom more than a few inches in thickness, and is doubtless to be attributed to some single great volcanic eruption of a date long antecedent to our historical knowledge of the north-west part of the continent.

GEORGE M. DAWSON.

SCIENTIFIC NEWS IN WASHINGTON.

National Academy of Sciences; Partial List of Papers; Presentation of Medals. — How to detect Cottonseed-Oil in Lard. — Aboriginal Copper-Workers in the Lake Superior Region; Proofs that they were Modern. — The Siana Indians; Investigations by the Bureau of Ethnology. — International Entomology.

National Academy of Sciences.

THE National Academy of Sciences has been holding its annual meeting in Washington during the past week, but too late to report its proceedings in this number. Among the features of the meeting were the presentation, on Wednesday evening, of the Henry Draper medal to Prof. Edward C. Pickering, director of the Harvard Observatory, for his work upon astronomical photography; the J. Lawrence Smith medal to Prof. H. A. Newton of Yale University, for his work on meteors; and the reading of memorial papers commemorative of Prof. J. C. Watson and Capt. James B. Eads, by Prof. G. C. Comstock of Wisconsin University, and Mr. William Sellers of Philadelphia, respectively.

Among the papers expected were the following: 'The Rotation of the Sun,' by Prof. J. E. Oliver of Cornell University, Ithaca, N.Y.; 'The Foundations of Chemistry,' by Dr. T. Sterry Hunt of Montreal, Canada; 'On an Improved Form of Quadrant Electrometer, with Remarks upon its Use,' by Prof. T. C. Mendenhall, director of the Rose Institute, Terre Haute, Ind.; 'On the Vertebrate Fauna of the Puerco Series,' by Prof. E. D. Cope of Philadelphia; 'Re-enforcement and Inhibition,' by Dr. Henry P. Bowditch of Harvard University; 'On Apparent Elasticity produced in an Apparatus by the Pressure of the Atmosphere, and the Bearing of the Phenomena upon the Hypothesis of Potential Energy,' by A. Graham Bell of Washington; 'The Orbits of Aerolites,' by Prof. H. A. Newton of Yale University.

Detection of Adulteration of Lards.

The recent examinations of lards made at the Agricultural Department have resulted in the discovery of a test by which the presence of cottonseed-oil may be detected instantly by any dealer or housekeeper. The experiment is as follows: As much lard as can be taken up on the point of a case-knife is placed in a teacup. About a quarter of an ounce of sulphuric acid is poured upon it and thoroughly mixed with it. If the lard is pure, it will coagulate, and there will be a little difficulty in the mixing. If it is adulterated with cottonseed-oil and stearine, the mixture will take place immediately and easily. After half a minute, one-fourth of an ounce more of sulphuric acid should be poured upon and mixed with it. The whole process thus far should not occupy more than one minute.

The substance thus obtained is poured into a common test-tube, such as may be bought at any chemist's shop for a few pennies. The acid, somewhat colored, will sink to the bottom, and the fatty substance will remain on top. If the lard thus tested was pure, the color of the latter will be that of a light-colored sponge, changing in a minute or so to a dark-cinnamon color. If it has been adulterated with cottonseed-oil, the color at first will be darker, changing immediately to a dark brown. These differences of color are so marked that no experience is required to detect them.

Cards might be printed upon which the colors produced by the sulphuric-acid re-action for both pure and adulterated lards might be shown; and dealers, by using this test, may prove to their customers in a minute or two that the lard that they are selling is an unadulterated article. The experiment is simple, and the cost of it almost nothing. The novel thing about it is the placing of the mixture in a test-tube in which the acid may become separated from the fatty substance, thus making the test much more decisive and satisfactory. This was first suggested by Dr. Thomas Taylor, who has extended his experiments to a great number of different animal and vegetable oils.

Algonkin Metalsmiths.

Mr. Henry Lee Reynolds read a paper before the Anthropological Society at a late meeting, in which he replied to M. Paul du Chatelier, who has discussed the great antiquity of the ancient mines discovered at Lake Superior, in 'Materiaux pour L'Histoire Primitive et Naturelle de l'Homme.' The idea, he said, that these mines were very ancient, is commonly prevalent. Although Drs. Charles T. Jackson and I. C. Lapham gave quite plausible reasons for thinking them to be the works of the present race of Indians, men like Wilson and Whittlesey subsequently published standard works in which they asserted their belief in a contrary opinion; and these latter theories are now being promulgated by a host of writers like M. du Chatelier.

Mr. Reynolds reviewed the evidence upon which these theories are based, criticised some of it as misleading and some of it as having lost its original importance and prominence in the light of later ethnologic and archæologic research, and expressed the opinion that the mines in question are the work of the ancestors of some of the historic Algonkin tribes, if not of the historic tribes themselves. In proof of this he quoted some pertinent testimony from early chroniclers to show that the copper reported as having been found among the historic tribes could not all have been drift-metal discovered upon the surface. Three sources whence the

aboriginal copper was obtained were mentioned, a general description of the pre-Columbian status of the art of copper-working given, and an account added of his own method of examining old records and studying archæologic discoveries in his endeavor to learn what this actually was.

The chief end of this paper, however, he said, was to present some facts which seemed to indicate active aboriginal mining operations subsequent to the arrival of the French in the Lake Superior region. After referring to some evidence which mound specimens offered on this point, he added, "But the best assurance of the later fabrication of our copper specimens is to be found in the fact that a vast quantity are discovered upon the surface, particularly in the States bordering upon Lake Superior, while an extremely small percentage come from the numerous mounds existing in the same territory. I examined, last summer, 231 specimens of copper in the possession of the Public Museum at Milwaukee, and 200 more in the cases of the Wisconsin Historical Society at Madison. Not one was found in a mound, but all were either picked up from the surface or turned up with the sod in cultivation of the fields. Now, these specimens, more or less exposed as they are to the action of the atmosphere, bear scarcely any indications of greater decomposition than the specimens found deep in the mounds. How can this be if they antedate the advent of the whites? They are mostly, if not all, implements; and all have been shaped out of native copper by patient handling, doubtless with the assistance, in some cases, of stone moulds. Some are of such shape as to give rise to the suspicion that the workman must have attempted an imitation of some tool or weapon which he had seen in the hands of the French pioneers. The resemblance of the knives and chisels to European ones is very marked, while several of the spear-heads are indeed close copies of the old-fashioned French pike which must have been carried in those days in establishing the Jesuit missions. In proof of this, I saw last summer, in Illinois, one of these old iron pike-heads which had been taken from a mound near by. It had the same three-sided or bevelled feature, formed by a slight ridge running through the centre of one side, which is so often seen in our spear-heads of native copper. Many of these spear-heads also have sockets, and a perforation for a rivet. Now, it is hard to realize how these two ideas of a socket and a hole for a rivet, if they are not imitations, can predominate, as they do, over the simpler form of a tang or notch and the customary Indian method of fastening; for the Indian's first impulse in handling copper would be to imitate the types of spear-heads that he had already fashioned in stone. Then, too, the imitation of these types in stone would have been the simplest forms in the fabrication of copper; and the simplest must, in the natural order of things, be the first that occurs to the uninfluenced native mind. That this suspicion is well founded is demonstrated by the discovery of one of these socket spear-heads in which a broken rivet remained. This rivet proved to be iron. The specimen was ploughed up in a Wisconsin field, and is described by Dr. J. D. Butler in the *American Antiquarian*, vol. iv. p. 232.

"Indian wares, we know, by successive barter or by appropriation by right of war, traversed a vast and extensive territory; yet it must be noted that there is no continental distribution of this class of copper implements such as is observable in other objects of American art. They seemed confined almost strictly to the territory reached by French influence, for in this limited area they outnumber by a surprising majority the aggregate of all specimens of a similar class, mound or surface, found elsewhere in the country."

A series of facts were then presented and commented upon, which give rise to the suspicion that the mines themselves postdate the arrival of the whites. Continuing, he said, "Valuable testimony bearing upon the probability of these observations is furnished by Dr. P. R. Hoy of Racine, Wis. This gentleman found in a grave in his State two crude pieces of mined copper, together with two blue-glass beads of European make. These two lumps of copper had sharp angles and ridges, showing conclusively that they had been mined; for, if they had been drift-copper, they would have been more or less worn and rounded. But this is not all. Among other things associated with those two little European beads was a copper lance-head similar in type and fabrication to one gathered from the *débris* of the Keweenaw mines.

"In the light of such facts as these, the question naturally arises, 'Were not the best part of the copper implements that have been found in Wisconsin, Michigan, and Illinois fabricated since the advent of the French?' It does not seem to have occurred to the writers who describe such specimens, that in those remote, unsettled parts of the country the Chippewas and Winnebagoes could have possessed and worked native copper for many years without the fact being generally known." Mr. Reynolds showed that this was the case, even as late as the second decade of the present century, by giving an extract from a letter of Satterlee Clark, who was the Indian agent for the Winnebagoes from 1828 to 1830.

The Siana Indians.

During last season, 1887, Professor Powell, director of the Bureau of Ethnology, directed that certain researches be made among the Siana Indians of New Mexico. This tribe is located on a mesa (tableland) overlooking the Rio Jemez, a stream draining the Jemez Mountains, and is one of the tributaries of the Rio Grande, forming a junction with that stream about eighty miles south of Santa Fé. There are three tribes of communal dwellers located on this stream, the Jemez, Sianas, and the Santa Anas, the latter two peoples speaking the same dialect. No general results have been of greater interest than those from Siana. This tribe now only numbers about one hundred and twenty-five individuals, though the ruins of their former habitations, which are immediately connected with those of the present, indicate an extensive population.

The habits and customs of these people are in principle much like those of other Pueblos, yet their ceremonials are peculiar to themselves. Their dances are all religious, one of which is the celebrated snake-dance, which occurs every alternate year. This peculiar dance occurs with only one other Pueblo tribe, the Mokis, in Arizona. The Sianas, however, perform this dance in a secluded spot some distance from their present village, which is so accessible to travellers that they are much disturbed at this time. Their other ceremonies are numerous, and are performed in supplication for prosperous crops, for rain, and for protection from disease and other misfortunes. The houses of their village are composed of large, round lava bowlders laid in mortar, on the same general plan of construction as those of other Pueblos. They are extremely idolatrous in their worship. Their estufas are stored with innumerable objects of such worship. In one may be seen a large altar composed of various animals representing the rattlesnake, bear, wolf, panther, wild-cat, and a few nude representations of mythic human beings, which to them are their gods of music, rain, war, etc. In different directions, and not very far distant from their village, are shrines for different gods, representing different great elements, to which these Indians continually pray.

The bureau secured large and representative collections of all the religious and domestic objects possessed by the tribe, also complete notes of their myths, religious rites, and ceremonials, which are to be elaborated for one of the forthcoming reports of the Bureau of Ethnology.

Some Recent Entomological Matters of International Concern.

This was the subject of a paper read before the Philosophical Society at its meeting, March 31, by Dr. C. V. Riley. Selecting three species of insects which prevail in several different parts of the world, and are injurious to agriculture or horticulture, he devoted his paper chiefly to a consideration of their natural history.

The first was the white or fluted scale, — the *Icerya*. This has of late years done great injury to the orange-grove, and to many other trees and shrubs of southern California. Its original home was probably Australia, whence it was introduced into New Zealand, Cape Town, South Africa, and California. All the evidence points to its introduction into that State by the late George Gordon of Menlo Park, about the year 1868, probably from Australia, on *Acacia latifolia*. The trees most injured by it are the acacia, lime, lemon, orange, quince, pomegranate, and walnut.

The second species of which Dr. Riley spoke was the Hessian-fly. An added interest has recently been given to it because of its introduction into England. It has long been known upon the continent of Europe, and the prevailing belief has been that it was introduced therefrom into the United States during the revolutionary war by

Hessian troops. It was first announced in England two years ago by Miss E. A. Ormerod, consulting entomologist of the Royal Agricultural Society, and it has proved more or less injurious. It has rapidly extended during the past two years, so that now it is found on most portions of the eastern coast, extending up into Scotland. In North America it has spread over the entire wheat-producing country, having appeared in California during the past three years. Dr. Riley thinks that all the evidence points to the importation of the Hessian-fly into England from the continent of Europe, and not from America. He is also of the opinion that on account of the cooler summers and milder winters, and the lateness at which wheat is sown in England, there is very little danger that the crops will be injured there to any such extent as in America and in portions of continental Europe. In fact, it is very injurious only under conditions where two generations are pretty likely produced in the same year; and he is satisfied that in England, as a rule, only one generation will be produced.

The third of the insect pests of which Dr. Riley spoke was the hop-plant louse, *Phorodon humuli*, of which the full life-history has been learned within the past year. It hibernates at the present season of the year. The little glossy, black, ovoid eggs of the species are found attached to the terminal twig, and especially in the more or less protected crevices around the bud, of different varieties and species of plums, both wild and cultivated. From this winter egg there hatches a stem-mother, which is characterized by being somewhat stouter, with shorter legs and honey-tubes, than in the individuals of any other generation. Three parthenogenetic generations are produced upon plums, the third becoming winged. This instinctively flies to the hop-plant, which is entirely free from attacks during the development of the three generations upon plums. A number of parthenogenetic generations are produced upon the hop, until in autumn, and particularly during the month of September, winged females are again produced. This is the pupifera or return migrant, and she instinctively returns to the plum. Here she at once settles, and in the course of a few days, according as weather permits, produces some three or more young. These are destined never to become winged, and are true sexual females. Somewhat later, on the hop, the true winged male, and the only male of the whole series, is developed; and these males also congregate upon the plum, on the leaves of which, towards the end of the season, they may be found pairing with the wingless females which stock the twigs with the winter egg. Twelve generations may be produced during the year, but there is great irregularity in the development of these generations, and the return migrant from the hop is produced at the end of the season, whether from individuals of the fourth or fifth generation, or of the twelfth. Each parthenogenetic female is capable of producing one hundred young (the stem-mother probably being more prolific), at the rate of one to six, or an average of three per day, under favorable conditions. Each generation begins to breed about the eighth day after birth, so that the issue from a single individual runs up easily, in the course of the summer, to trillions. The progeny from a single stem-mother may, under favoring circumstances, blight hundreds of acres in the course of two or three months.

The exact knowledge thus gained, said Dr. Riley, simplifies the protection of the hop-plant from *Phorodon* attack. He suggested destroying the insect on the cultivated plum in early spring, and the extermination of the wild-plum trees in the woods. The introduction of the pest into new hop countries in the egg state upon plum cuttings or scions may be avoided. Infection from one hop-yard to another never takes place.

ELECTRICAL SCIENCE.

Electrical Energy from Carbon without Heat.

A FEW years ago Mr. Willard E. Case brought forward a battery in which an electric current was generated without the consumption of the elements of the cell, the energy being derived from some external source of heat. The electrodes were tin and platinum immersed in a solution of chromic chloride, which, at ordinary temperatures, has no action on the plates. If the cell be heated, "part of one of its elements, chlorine, leaves the chromic chloride, goes over and temporarily combines with the tin, forming a proto-chloride of tin." This action generates an electric current with an electro-motive force of about .3 of a volt. When the cell is allowed to cool, the tin crystallizes out again, and the cell is as it was before. We have, then, a current of electricity the energy of which is obtained from the source of heat applied to the cell, the possible efficiency of the arrangement being fifteen or sixteen per cent. For many reasons this cell cannot be practically used; but Mr. Case has pursued the general subject, and, in a paper lately read before the Institute of Electrical Engineers, he has brought forward some extremely interesting and suggestive experiments. It is probable that the ultimate sources from which electrical energy will be derived are natural sources of power, — waterfalls, etc., and coal; the conversion in the latter case being direct. For the former a perfected storage-battery is necessary; for the latter, some means of oxidizing the coal without the production of heat, the energy being converted directly into electric currents. Mr. Case's experiments in the latter field are as follows: "In a glass cell containing sulphuric acid C.P. (specific gravity 1.81, temperature 75° F.) two electrodes were immersed, — one of platinum, the other of lump graphite. Only a slight electro-motive force was indicated, .007 of a volt, due to the combination, the graphite acting as the positive element. On the addition of a small quantity of chlorate of potassium to the acid, the electro-motive force immediately rose to .8 of a volt, the graphite being disintegrated after a time. This cell polarized rapidly, which was partially prevented by mechanical means. . . . A method of exclusion was adopted to ascertain the oxidant of this electrolyte: chlorine peroxide ($Cl\,O_2$) appeared to be the only active agent. It is decomposed by the carbon, chlorine being evolved with some oxygen. It was assumed that in this cell graphitic acid ($C_{11}H_4O_5$) was formed as the result of the chemical actions." Different forms of carbon were tried in the cell, giving a different electro-motive force for each form, varying from .3 of a volt to 1.25 volts.

Mr. Case sums up the results as follows: "Undoubtedly the direction of experiments in the future will be to find some cheap substance which will absorb oxygen from the air and give it up to the carbon; in fact, acting as a carrier of oxygen, so oxidizing it without heat. And this is not improbable, as we already know of substances which do this, though giving a low electro-motive force: thus, for instance, the ferric salts are reduced to ferrous by agitating their solutions with carbon, being regenerated by absorbing oxygen from the air. By pursuing this line of investigation, we can be sure we are not ignorantly striving against any law of nature when attempting to convert the whole potential energy of carbon into electrical energy."

If we take the energies of combination of different substances as indicating approximately the electro-motive force obtainable from the action, we will find, in looking at the tables giving energies corresponding to various chemical actions, that the greatest electro-motive force we can hope for with batteries in which metals are consumed does not exceed three or four volts. With the hydrocarbons it is different: the energy in some cases is very great; and a battery in which part of the action consists of the formation of some hydrocarbon, or the change from one hydrocarbon to another, might give a much greater electro-motive force than any battery with which we are acquainted. It is very probable that some one will discover a practicable battery of the type Mr. Case has pointed out.

MAXIMUM EFFICIENCY OF INCANDESCENT LAMPS. — Two things are very well known about incandescent electric lamps: their efficiency increases as we increase the current through them, and their brilliancy, and their life decreases from the same causes. There are two items of cost in electric lighting, — the cost of the current supplied to the lamp, and the cost of renewal of the lamps themselves. By running lamps at a very high candle-power, we decrease the amount of current required per candle, but our bill for breakage of lamps is correspondingly increased. Now, it is evident that if we know the cost of the current and lamps, and the life of lamps corresponding to different efficiencies, we can calculate the least expensive way to run our lamps. This Mr. Howell has done in an excellent paper read before the American Institute of Electrical Engineers. He has obtained, in the first place, the efficiency of certain Edison lamps corresponding to different candle-powers

at which they are burned. From another long series of experiments he finds the life of the lamps corresponding to the different efficiencies. With these results, and assuming different prices of current and lamps, Mr. Howell plots curves representing the total cost of operating one hundred sixteen-candle power lamps for one thousand hours; the points of the curves being obtained by varying the efficiency at which the lamps are run, and calculating the total cost from the data he has obtained and assumed. These curves give a definite minimum corresponding to some definite efficiency, the latter varying with the price of current and lamps. These curves are important, as they enable us at once, knowing how much the current costs, to select lamps that will give the best results. On comparing the cost of lamps with the total cost, Mr. Howell finds that in every case the total cost is a minimum when the cost of lamps is about fifteen per cent of the total cost, — a curious and important result.

ELECTRIC LIGHTING AND INSURANCE. — A reduction in insurance rates, where electric lights are exclusively used, has just been voted by the New England Insurance Exchange. The reduction is, however, only allowed where the rules of the exchange are followed in installing the plant, and where the company whose apparatus is used shall pay "any sum assessed as its proportion to defray the cost of inspection." This move has several things to recommend it: it gives to electric lighting the advantage which its superior safety warrants, and it insures the careful installing and regular inspection of the plant. It is in this last that the benefit is greatest. The few fires for which electric lighting is responsible have been the result of cheap and careless work, and with efficient inspection this is impossible. With the wires and appliances that can be purchased to-day, electric lights can be put in buildings in a way to make accident impossible, and electricians can thank their own ill-advised 'economy' for the ill repute in which some people hold the system.

THE DE BERNADO ACCUMULATOR. — It is possible that in the final perfected type of accumulator, different patterns will be used for different purposes. At present the 'grid' type of battery-plate used for lighting-purposes is much thicker and heavier than that used for traction-work. It has long been acknowledged, that, where a very heavy current is to be taken from a cell, the Planté form of plate is preferable to the former, in which the active material is pasted into perforations in cast-lead plates; and there seems a tendency, especially in France, to return to some modification of Planté's original idea. De Bernado requires in his welding process a heavy current of electricity; and to obtain it he has devised a new form of accumulator, which will stand the discharge rate required without any very rapid deterioration. The cell does not differ greatly from the Kabath accumulator, which attracted attention some years ago, but which is now little used. The plate consists of a frame of lead, with lead strips passing from one side to the other of the framework. The alternate strips are corrugated obliquely to give circulation, and all of them are burned at their ends to the frame. The plates so made are 'formed' by the Planté process; that is, by reversing the direction of the current passing between two sets of plates immersed in sulphuric acid, at intervals, until an 'active' coating of sufficient depth is produced. There is nothing especially new about this battery, — it differs but little from the Kabath accumulator, — but it is of interest as indicating the gradual return to the original Planté form, or some modification of it, that is gradually taking place, especially where rough usage is necessary.

HEALTH MATTERS.

Lung-Expansion and Consumption.

DR. THOMAS J. MAYS of Philadelphia, in a paper read before the Philadelphia County Medical Society, still further elaborates the theory which he has repeatedly expressed, and to which *Science* has before referred. This theory is, that an insufficient expansion of the lungs, especially of their apices, has more to do with the development of consumption than the breathing of impure air, and that, for the prevention of the disease, complete expansion of these organs is more important than the breathing of pure air. The title of his paper is 'Apex-Expansion *versus* Pure Air in Pulmonary Consumption.'

Although Dr. Mays acknowledges that wholesome air is of value in the prevention and treatment of consumption, still he is convinced that the purity of the atmosphere plays but a small part in the result. He cites the almost complete exemption from pulmonary consumption of the inhabitants of Iceland, Greenland, and Lapland, whose habitations are notoriously wanting in ventilation, as proof that this disease is not the result of breathing a vitiated and impure atmosphere. On the other hand, people living in tropical regions, who are out of doors most of the time, are by no means free from consumption. Miners and laborers in coal-mines, although continually respiring an atmosphere loaded with impurities, and damp and musty, suffer but very little from this disease.

That which has been an important factor in establishing the belief that pure air is such an essential element in limiting the ravages of consumption, is that those who occupy elevated or mountainous regions are less liable to this disease than those who live near the sea-level. In reference to this fact, Dr. Mays says that it is estimated that at an elevation of six thousand feet the surface of the body is relieved of nearly seven thousand pounds' pressure. When such an enormous weight is lifted from the body, it is quite evident that its interior must also be markedly affected: the pulse is accelerated from fifteen to twenty beats per minute; the respiration is quickened from ten to fifteen breaths per minute; and evaporation from the skin and lungs is increased. These are some of the immediate effects. Protracted residence in such a high region enlarges the chest capacity. The Quichua Indians, who dwell on the elevated tablelands of Peru, have enormous-sized chests, containing capacious lungs with large air-cells. The Mexican Indians possess chests which are out of proportion to the sizes of the individuals. Dr. Denison says that children born in the Rocky Mountains have chests of unusually large capacity, and M. Jaccoud states that at St. Moritz the respirations are not only more frequent, but fuller.

The reason why the number of respirations increases while ascending a high elevation becomes clear when we take into consideration the fact that at the sea-level a cubic foot of dry air contains about 130 grains of oxygen, while at an elevation of six thousand feet it contains only about 106 grains, — nearly twenty-five per cent less than the body is accustomed to breathe at or near the seaboard.

Professor Mosso has recently proven experimentally that man possesses a lung capacity which is nearly one-fourth larger than the actual necessities of life at the sea-level demand; hence by employing his whole lung capacity he can extract a sufficient amount of oxygen from this attenuated atmosphere without difficulty. And herein lies the secret why so many consumptives, and others with weak lungs, derive such a great benefit when they resort to a mountain climate. Every available space in the chest is brought into requisition to furnish the needed amount of oxygen, the apices are called out of their lethargic state, and the alveoli are inflated; and, if the infiltrated areas are not dispersed, the surrounding alveoli are kept permeable, and so the disease is at least limited, and called into abeyance.

In concluding his paper, Dr. Mays says, "Now, after reviewing the whole subject, we are driven to the conclusion that the line of immunity from consumption, which in the early history of our country was located at the Atlantic seaboard, and which has gradually receded westward with the tide of civilization, until at present it has reached the latitude of Colorado, will not stop in its course until it touches the shores of the Pacific; that the question of curing the disease does not depend on the purity or freshness of the air, or upon the number of bacilli which the atmosphere may contain, or upon the amount of oxygen which may be introduced into the body, for these are all secondary considerations; but it is simply a mechanical question, — a question as to the best mode of expanding the lungs, and especially the apices of our round-shouldered and flat-chested patients, of removing the infiltrated products already existing, and of enhancing the constitutional resistance."

LEPROSY IN AMERICA. — The recent cases of leprosy in Philadelphia have been the means of awakening a new interest in that loathsome disease. Dr. Charles W. Allen, in the *New York Medical Journal*, gives a most complete account of the disease, and the views of the best authorities regarding its communicability.

His conclusions are as follows: 1. Leprosy has existed to a considerable extent in this country during the past twenty years; 2. The tendency is for the disease to increase, not only from immigration, but also from the occurrence of sporadic cases; 3. It is a contagious disease, and may be transmitted from parent to offspring; 4. Transmission probably takes place, in some instances at least, through inoculation; 5. Segregation has been proved to be the only sure means of freeing a country from its ravages; 6. It is the duty of the government to establish central leper-hospitals or isolated settlements for the treatment of those afflicted, and for the protection of the community at large.

BURNING GARBAGE. — Sanitarians in this country have for many years been considering the practicability of destroying the garbage of a city by fire. The city of Milwaukee has been a pioneer in the movement to demonstrate the feasibility of this method of disposal. The commissioner of health of that city, in a recent letter to the *Sanitary News*, gives some interesting facts concerning the experience of that city. "For more than five months our garbage has been consumed to a dry, inodorous ash. A test of the cost of consuming the garbage was made on Dec. 27, with the following result: the amount received and consumed was 40,215 pounds, and the fuel required was 5,000 pounds, being 4.3 cents per hundred pounds of garbage consumed, — a result highly gratifying when we consider that on that date there was a large quantity of snow and ice mixed with the garbage."

BOOK-REVIEWS.

Volcanoes and Earthquakes. By SAMUEL KNEELAND. Boston, Lothrop. 8°.

THE present volume is mostly a description of ascents of volcanoes and of remarkable eruptions which the author has witnessed, or the description of which he has taken from reliable sources. Thus the book has some value as a book of travel, or for making clear the phenomena of volcanic action to the general reader. The author has visited so many volcanic regions, — the Hawaiian Islands, Iceland, the Mediterranean Sea, Japan, and the islands of south-eastern Asia, — that he is well able to give a description of the peculiarities of the various volcanoes; and the principal value of the book lies in the vividness of the descriptions, which is due to the personal knowledge of the author of so great a part of the earth's surface. He wisely abstains from a long discussion of the theory of volcanic phenomena, as this would be out of place in a popular book like this, but merely enumerates the various theories that are now held by geologists. The latter part of the book contains descriptions of remarkable earthquakes.

Lectures on the Physiology of Plants. By JULIUS VON SACHS. Tr. by H. Marshall Ward. Oxford, Clarendon Pr. 8°. (New York, Macmillan, $8.)

VON SACHS'S text-book of botany has always been regarded as one of the best in any language, and no better proof of this can be given than the fact that four editions have been published and exhausted. Dr. Sachs was requested by the publishers of his text-book, and also by his botanical friends, to prepare a fifth edition. This he declined to do, and gives his reasons therefor in the following language: "It is an old experience, that, while one works up with pleasure a second and even third edition of a comprehensive work, frequent repetition eventually becomes inconvenient or even painful to the author. Having experienced this sufficiently with the fourth edition, I was unable to make up my mind to a fifth. Apart from other circumstances, I was driven to this, to an important extent, by the progressive development of my scientific convictions." He adds, that his mode of comprehending important questions of the physiology of plants had undergone changes in various directions, and that for several years the wish had been taking a more and more definite form, in his mind, to set forth the most important results of the physiology of plants in such a manner that not only students, but also wider circles, should be interested in them. Believing that this object could be better attained by a freer form of exposition than that of a text-book, he determined to present the subject in the form of lectures. This determination has resulted in the 'Vorlesungen über Pflanzen-physiologie, which Professor Ward has translated in a most admirable manner.

The volume consists of forty-six lectures, arranged in six parts. These latter are, 1. Organography; 2. The external conditions of vegetable life, and the properties of plants; 3. Nutrition; 4. Growth; 5. Irritability; 6. Reproduction. It is impossible to give more than this brief outline of a book which embraces so many and such varied topics as are treated in the eight hundred and two pages of text. Professor Sachs has succeeded in his undertaking, to a degree which is exceptional, to produce in this series of lectures a treatise adapted to the wants of the skilled botanist and the educated man, whose studies have been in other directions, but whose desire for a knowledge of the physiology of plants has hitherto been unsatisfied. The subject is made much more intelligible by the four hundred and fifty-five woodcuts with which the book is embellished; while the elaborate index, covering thirty-three pages, makes it exceedingly valuable for reference.

Photography applied to Surveying. By HENRY A. REED, U.S.A. New York, Wiley. 4°. $2.50.

THE author gives a concise sketch of the successful experiments made in photographic surveying, and sets forth the methods now in use. The book is principally founded on the publications of Frenchmen who have paid particular attention to developing this branch of the art of surveying. The author's discussions of the various methods are clear and concise. The principle of photographic surveying is the same as that of ordinary surveying. Stations are occupied by the photographer; and the angles, which are generally measured by the theodolite, are measured on the photographic negative. For this purpose the camera is provided with a level, and the distance between the sensitive plate and the object-glass is kept constant. The horizon is marked on the negative, and a measurement of distances serves for finding the azimuths and elevations of objects. In making the photographs, various instruments are used, — the ordinary camera, with a wide-angle objective; a camera in which a cylindrical sheet of sensitive paper takes the place of the plate, and in which the photograph is produced by turning the camera around its axis; or the photographic plane table. In the latter the photographic view is represented on a horizontal surface, the rays from the object being reflected either by a triangular glass prism or by a spherical convex reflector. The author justly claims great advantages for these methods, among which the most valuable are the cheapness of field-work, and the great amount of information contained in the photographic views. Setting aside geodetic operations, photographic surveying is undoubtedly the cheapest and best method wherever the principal object is to attain, not the greatest possible accuracy, but the fullest amount of information in the shortest possible time. Therefore the publication is very valuable and welcome, giving a concise review of the advantages and results of this method, which is still very little used in this country. We may be allowed to add a few remarks on this subject, in addition to Lieutenant Reed's full discussion. Photographic surveying cannot attain the same accuracy as ordinary surveying; but the errors are so small, that for tertiary, and even for secondary triangulation, it meets all demands. Its greatest value, however, lies in the full material it furnishes for constructing the orographic features of a country. No topographer, however experienced he may be, can draw contour lines as well from sketches and a few fixed points as he can construct them from photographic surveys. The number of elevations that may be determined by this method is practically without limit. Another important use of photographic work is the facility it affords for re-surveying tracts of land, particularly in regard to changes in culture. Deforestation, roads, the extent of agricultural land, etc., are shown on the photographs, and may readily be inserted in maps without fear of omissions. Thus it will be of the greatest utility for the questions of a census. Lieutenant Reed touches only slightly upon its use in reconnaissance work. For this purpose the cylindric arrangement gives the greatest satisfaction, principally as it dispenses with the use of bulky and heavy photographic plates, which are difficult to carry. For topographic work of this kind, the use of photography, supplemented by sketches made by the *camera lucida*, gives by far the best results. A concluding chapter of the book

deals with telescopic and balloon photography. We do not believe that the latter will be of great service to the surveyor, except in cases of war for the military engineer, and it may be useful for showing the culture of extensive tracts of land without commanding points in resurveying.

Beginner's Anatomy, Physiology, and Hygiene. By JOHN C. CUTTER. Philadelphia, Lippincott. 16°. 30 cents.

FROM the title of this book, and from the preface, we gather that it is intended for young pupils, for beginners, and we are therefore gratified to find that the writer proposes to employ such language as is simple and direct, and that technical and long words are, as far as possible, avoided. Throughout the text this rule has been fairly well adhered to, though when our eyes fell upon the frontispiece, we began to fear that the author had forgotten to carry out the plan which he had promised. This frontispiece represents the muscular system of the human body, and the scientific names of these muscles are given as they would be in the most advanced work on anatomy. Orbicularis palpebrarum, occipito-frontalis, sterno-cleido-mastoid, extensor carpi-radialis, and others too numerous to mention, stand out prominently in the illustration. This same criticism applies to other figures in the book, although perhaps to a less degree.

While it may be well to describe the effects of alcohol and tobacco in such a work as this (and of course, to meet the demand for which this and so many other books of this kind have been recently written, this must be done), we question whether it is wise to speak of the effects of chloral. The writer says of it, that, "when used for some time, it may cause heart-trouble. It lessens the heart's power. It makes its action irregular. It sometimes, in a small dose, causes death by suddenly stopping the heart's action." In another portion of the book he says that in proper doses it induces rest and sleep. This kind of talk should, in our judgment, be omitted from a book written especially for beginners. The phraseology of some parts of the book is open to unfavorable criticism. In speaking of deformities of bones of children and youth, the author says that corsets and snug-fitting shoes ought not to be worn by the young, the inference from which statement would seem to be that these articles may be worn by the adult; and yet in another place he says, "Do not wear close-fitting chest and waist garments. Corsets and tight vests compress the lower ribs. They press the digestive organs out of place. They hinder deep and proper breathing."

Another inconsistency we observe in the following statements: "Cheese is a rich and hearty food, suitable for hard workers." "A food which disagrees with a person ought to be avoided. As a rule, pastry, cheese, fresh white bread, and 'made dishes,' most often cause discomfort." Dr. Cutter is opposed to candies for children. He says that common pure candies contain not only cane-sugar, but materials which are difficult to digest. Candies "should be denied children." We think the doctor goes a little too far in thus absolutely prohibiting the use of candies. There is no doubt that they are abused, and that it would be far better not to use them at all than to continue their excessive use; but at proper times, and in proper quantities, we do not think that good candies are so pernicious as he would have us believe.

The author incorporates in his book what he calls "simple directions for the management of a few common emergent cases," which, from the references already made, we infer are intended as a guide to the young pupil, the beginner. Under the heading 'Management of a Poison Case,' he says, "If it is an irritant poison (like verdigris, corrosive sublimate, etc.), give rapidly-beaten-up eggs. If it is an opium compound, give strong coffee, and keep the patient awake. If it is a vegetable narcotic (henbane, belladonna), keep him quiet. Always summon the ablest doctor to manage the case." It would, we imagine, be a sufficiently difficult task, especially for a young pupil, to determine whether the poison taken was an irritant, an opium compound, or a vegetable narcotic; but to decide who is the 'ablest' doctor, *hic labor, hoc opus est.*

While there is much in this book to criticise, there are also many things to commend. The general arrangement is good, and the figures are fairly illustrative of the text. There is one feature which is especially noteworthy, and should be reproduced by writers of other text-books of this kind. We refer to the instructions to teachers for the demonstration to classes of the principles of physiology; as, for instance, the demonstration of the movements of the blood in a frog under the microscope, and the changes which take place in the size of the human chest during inspiration and expiration; and the impoverishment of the air during respiration. This method has been admirably worked out by Professor Martin of Johns Hopkins University, in his text-books; and we are glad to see that Dr. Cutter has embodied the same plan in his book.

Taken as a whole, 'The Beginner's Anatomy, Physiology, and Hygiene,' is neither better nor worse than many other books of the same class, scores of which have lately issued from the press in response to the demand for physiologies which should teach the effects of alcohol and narcotics.

A Treatise on Algebra. By CHARLES SMITH, M.A. New York, Macmillan. 8°. $1.90.

THIS work is the latest put forth by the English press, which is just now very prolific in algebras.

The present work is intended for students who already have some knowledge of elementary algebra. For this reason the opening chapters, while complete, are nevertheless brief.

These chapters differ but little from those of the text-books in common use. Stress is laid, however, on the idea that algebra is simply the science of numbers; and the commutative, associative, distributive, and index laws are well illustrated.

Some theorems are introduced much earlier than usual. Thus, detached co-efficients are introduced in the chapter on multiplication, and the theorems on the divisibility of rational integral expressions in the chapter on factoring. In this last chapter, also, the quadratic expression ax^2+bx+c is resolved into its linear factors; and this method of resolving into factors is adopted for the solution of all quadratic equations.

Chapter IX. treats of equations with one unknown, — simple, quadratic, binomial, and reciprocal, — and contains so much, that it is decidedly confused, and the weakest chapter of the book. Here, also, the author fails to explain the terms 'infinite' and 'infinity' in a satisfactory manner.

Chapter XII. is on symbolic algebra, and contains seventy excellent examples.

Imaginaries are treated by modern methods. In the definition of 'arithmetical progression,' the customary *lapsus calami* is made. Choice should be illustrated with more examples. Series are fully and clearly treated. The binomial theorem is proved by a modification of Euler's proof, based on the introduction of Vandermonde's theorem. Euler's own proof is also given. Logarithms are considered without any thing being said about the proof of the index law for incommensurable exponents, the almost universal omission.

The definition of 'probability' is the usual faulty one given by Todhunter and others. This chapter is not clear, and is too short.

The chapter on determinants is based on the well-known works of Muir and Dostor, and is by far the best short treatment of determinants with which we are acquainted in any language. This chapter contains all the essential parts of the subject, and we recommend it to every one who desires a brief but comprehensive knowledge of these famous expressions.

On the whole, the book much resembles that of Mr. Todhunter. In form Mr. Smith has improved on the latter's work; but in fundamental ideas, — ideas which go down to the root of mathematical reasoning, — and in definitions, Mr. Smith's work is but little, if any, superior to Mr. Todhunter's. The book is simply an excellent text-book of high grade, its most distinctive feature being the chapter on determinants.

Eighteenth Annual Report of the Massachusetts Bureau of Statistics of Labor. Boston, State. 8°.

CARROLL D. WRIGHT'S Massachusetts report for 1887 deals very exhaustively with a single subject, — the unemployed. The figures taken are those of the State census of 1885, and show a wide distribution of the unemployed as a whole, because the industries of the State were in a more or less depressed condition. The investigation comprehended "all remunerative occupations, of whatever

description, and included all persons of any age who were earning their living: that is to say, all persons engaged in the government service, whether national, state, city, town, or county; all professional people; all persons engaged in domestic and personal service, with the exception of housewives and those who assisted in the housework at home only, and for which they received no stated compensation; all persons engaged in the various branches of trade, in transportation, agriculture, the fisheries, manufactures, and mining; day-laborers; apprentices, and those who for various reasons were unemployed for the entire year; the unemployment being properly classified as regards each occupation in presenting results." The chief purpose of the inquiry was to ascertain, so far as possible, first the depression, if any, in particular trades or industries; and, second, the extent of unemployment generally, without regard to the particular kind of work performed during the twelve months preceding the taking of the census.

The main results, as shown in Mr. Wright's summary, are as follows: the whole number of persons, of both sexes, who were unemployed at their principal occupation during some part of the year represented by the twelve months which preceded the census enumeration of population, May 1, 1885, was 241,589. Of this number, 178,628 were males, and 62,961 were females. As compared with the total population of the State, this shows that for every 8.04 persons there was one person unemployed for some part of the year at his principal occupation; and as regards sex, that there was for every 5.22 males one male unemployed, and for every 16.03 females one female unemployed, at principal occupation during some portion of the time covered by the investigation. By 'unemployed' is meant, of course, unemployed at their principal occupation *during some part* of the twelve months preceding May 1, 1885. As a matter of fact, only 822 persons, less than one-third of one per cent, were unemployed during the entire twelve months. Of the unemployed, 73.94 per cent were males, and 26.06 per cent females. Of the 822 unemployed during the entire year preceding May 1, 1885, 91.61 per cent were males, and 8.39 per cent females. More than 50 per cent of unemployed were from twenty to thirty-nine years of age. Perhaps the pith of the report is given on p. 266, where it is said, "A little less than one-third of the persons returned as being engaged in remunerative labor were unemployed for about one-third of their working time; while, on the other hand, the working population of the State, considered in its entirety, were employed at their principal occupation for a little less than eleven months during the census year." The results of the investigation would seem to indicate, Mr. Wright points out, that all the products of manufactures could have been secured by steady work for 307 working-days, of 9.04 hours each, if this steady work could have been distributed equally among all the persons engaged in manufactures; while all the remunerative work of the State, of whatever kind, if it could have been distributed equally among the entire working population, could have been accomplished in 307 working-days, averaging 8.99 hours per day.

The report is extremely valuable, and one more evidence that Colonel Wright is the right man, in the right place.

Manual for Instruction in Domestic Science. New York, Industrial Education Association, 1888.

THE prefatory note of this little volume states that it is a manual "drawn up for the use of the students of the College for the Training of Teachers, and for such teachers as adopt the method of instruction followed at the college by Miss Julia H. Oakley, professor of domestic economy there. It is not intended to be complete or exhaustive. Its aim is to give the outline of a carefully developed course of instruction in cooking, which shall have an educational rather than a technical value, and to furnish notes for the conduct of the same." All persons who are watching the manual-training movement will admit at once that this manual, and others like it for sewing, industrial art, and wood-working, are absolutely necessary, if crude and empirical methods are to be kept out of the schools. They are as essential as good text-books in arithmetic and grammar. This manual is simple and clear, and will be of great assistance to teachers. For each lesson an outline is given, and the principles it illustrates carefully developed, before the recipe for its practical illustration is stated. This prevents mere imitation, and makes the practical work of the domestic science course rational and educational. The manual will doubtless be widely used, and its influence will be wholly for good.

Mechanics of Materials. By IRVING P. CHURCH. New York, Wiley. 8°. $3.

THE modern tendency in writing text-books upon the relation of forces, and their resistances as manifested upon and in the materials employed in engineering, appears to be toward a clearer stratification of the various departments of that branch of science.

Dynamics and statics have long been clearly defined, but there are many books at this moment before the eyes of students, in which the science of statics and the properties of materials are too promiscuously treated to leave a clear impression except upon the initiated. The result is, that the average student has but a vague idea of what he has been studying, and of its relation to other branches of science.

Professor Church's plan of treatment is a threefold division into dynamics, statics, and, to quote his own words, "mechanics of materials: a treatise on the elasticity and strength of beams, columns, arches, etc., for students of engineering." The latter title is that of his latest work, now under discussion. It is a book of 320 pages, and might properly be called a treatise upon molecular mechanics, being a discussion of the laws of resistance to externally applied forces of the molecular fibres of materials when used in various forms.

The treatment of the subject is independent of the kind of material — steel, iron, wood, etc. — so far as the development of the formula is concerned, as they are based upon certain mechanical assumptions, that are independent of the nature of the material.

That phase of the subject which will perhaps never submit to pure mathematical analysis — the properties of materials, the behavior of various kinds of materials under stress, the laws of fatigue, proper working-stresses, etc. — is very properly passed over with an occasional allusion, and such tables of values as may be necessary to solve the problems dispersed through the book.

In this connection it may be said that a table in which the average ultimate tensile strength of soft steel is given at 80,000 pounds, and of wrought iron at 60,000 pounds, without further explanation, is calculated to give the student an erroneous impression of the latest practice, in which even 55,000-pound steel has been recommended for bridge-work, and 80,000-pound steel is considered a high grade to use.

Again: an allusion to Wöhler's law of fatigue of materials as a recent discovery seems a misleading expression to apply to investigations made twenty years or more ago. But it is far easier to criticise minor points than it is to improve on the main features of Professor Church's work, an investigation of which discloses the following plan: —

The first chapter discusses the theory of stress and strain; and by mathematical investigation, of the action upon an assumed form of elements of the mass, the nature and relation of direct tension or compression, and shear, to each other, are clearly defined. The modulus of elasticity is explained; and, in short, all the fundamental principles of stress and strain in the abstract are shown in their true relations.

Chapters II.–V. inclusive, occupying about one-third of the book, relate to torsion and to flexure of beams.

The generally employed theories of Xavier have been used instead of a more intricate mathematical analysis, and a specially clear statement is made of the assumption upon which the formulæ for beams are based. Column formulæ are treated in the twenty-three pages comprising Chapter VI. The usual presentation of Euler's, Hodgkinson's, and Gordon's theoretical formulæ occurs, and some allusion is made to modifications in practice.

Consistency, perhaps, prevented Professor Church from giving what students much need, — a clear statement of what our engineers are actually doing in practice with the designing of columns, and the fact that certain simple formulæ derived from experiment seem to agree with actual tests fully as well as, if not better than, those mentioned.

Chapters VII.–XI. inclusive, taking about one-third of the space, treat of arches mainly by the use of the moment polygon. The in-

sertion of the analytical chapter on linear arches is chiefly a concession to the mathematical students.

The final chapter is devoted to the graphics of the continuous girder, as an appropriate conclusion to the graphics of the arched rib of which the former is a special case.

The topics are frequently illustrated, calculus in its simplest form is employed, the equations are carefully described, and special attention is given to a proper defining of the values and character of the various data used.

A general view of the book as a whole leads to the opinion that the line of treatment has been clearly thought out by the author, and each topic logically developed in its proper place. In that respect it is worthy of all praise, but the impression is at the same time created, that, as a text-book for technical schools, it is too elaborate. For those who make a special study of its branch of engineering, it is admirable: for the average student, who has many other topics to share the attention and time of his course, much pruning would be necessary, to the detriment of his understanding of the subject as a whole.

Chips from a Teacher's Workshop. By L. R. KLEMM. Boston, Lee & Shepard. 16°.

MR. KLEMM has put together the most practical little book on education that has recently come from the press. It is scrappy, to be sure, but it is comprehensive. If the style is jerky, and at times harsh, it is also concise. The contents of the book are not wholly new. Many, if not most, of the chapters have appeared as articles in educational journals. But the author is quite right in believing them worth reproducing in book form. Too frequently the teachers of the country are written *at*: Mr. Klemm does not write *at*, but *to* them. He is most successful when handling and illustrating the details of schoolroom-work. His more elaborate essays are not so good. His chapter of 'Open Letters to a Young Teacher' will appeal to thousands, and ought to appeal to tens of thousands, of readers. They all ask the very questions, at some time or other, that Mr. Klemm answers. They would turn in vain to the encyclopædia, or the formal book on pedagogy, or the psychology text-book, for any hint as to how to overcome chronic tardiness or uncleanliness in pupils. Mr. Klemm's experience furnishes some excellent suggestions as to how to proceed. We have never seen more ingenious and effective devices for arousing interest and making instruction comprehensible than his board for teaching numeration, his use of paper-folding in teaching fractions, and his original illustrations, from the boundary-lines of the several States of the Union, of the proper way to connect the teaching of history and geography.

We must bear in mind that the teaching force is largely distributed in rural districts. It is far from lectures and libraries, and remote from the centres of civilization. It wants to know how it may improve practically. It wants both knowledge and skill. It needs devices, not essays. It wants to be guided, not preached at. Mr. Klemm knows these facts, and has written this book accordingly. It is especially adapted to the needs of the country teacher.

NOTES AND NEWS.

THE agricultural experiment station of the University of Tennessee, Knoxville, has been re-organized, with the following officers: director, Charles W. Dabney, jun.; assistant director, in charge of field and feeding experiments, Charles S. Plumb; botanist and horticulturist, F. Lamson Scribner; chemist, Winthrop E. Stone; entomologist, Henry E. Summers; assistant in field and feeding experiments, Charles L. Newman.

— On Monday evening, April 16, 1888, after the adjournment of the regular business of the New York Academy of Sciences, the members interested in mineralogy held a meeting for the purpose of establishing a section on mineralogy. This section will meet when enough interesting material presents itself before the New York Mineralogical Club to insure a full evening of business, and will publish all papers presented before the Mineralogical Club in the Proceedings of the Academy. Mr. George F. Kunz was elected president, and Mr. J. H. Caswell secretary, of the section.

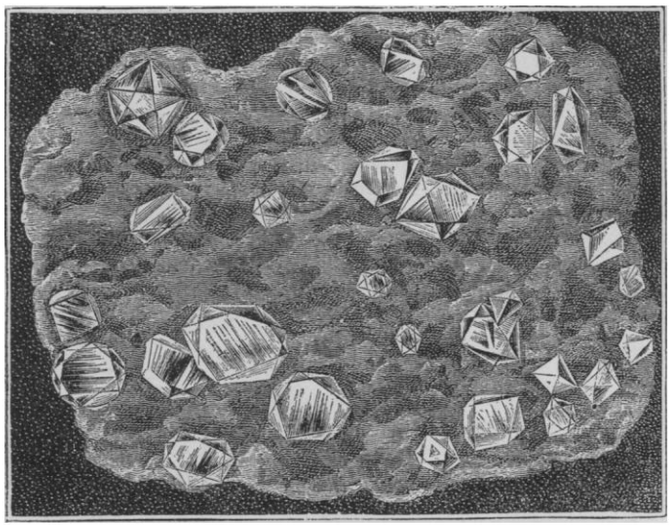
— Several years ago the Danish Government sent out a number of expeditions into the interior of Greenland. These were followed by Nordenskiöld's and Peary's expeditions. In the coming summer Dr. Frithjof Nansen of Bergen will make an attempt to cross the desolate ice-covered highland of Greenland, starting from the east coast. He intends to start from the neighborhood of Cape Dan with three companions, and will attempt to reach the Danish colonies on the west coast. It is doubtful whether he will succeed in reaching the coast in time, as a wide belt of pack-ice prevents ships approaching it. From former experiences, it would seem that Cape Dan, where the coast makes a sharp bend, is the place where approach is easiest; but the whalers who will convey Dr. Nansen to Greenland do not penetrate the heavy masses of ice lying close to the coast of Greenland. The ice generally opens late in the season, and it is to be feared that travelling on the inland ice will be very difficult at that season. Nordenskiöld's and Peary's experiences show that early in spring, before the commencement of the thaw, is the best time for such an enterprise: therefore it would seem that success is most probable for a traveller who would winter in Greenland.

— Of late years the Portuguese have made attempts to increase their influence in the countries adjoining the colony of Benguela. For this purpose Major de Carvalho was sent into the empire of Lunda, from which journey he returned in October, 1887, after an absence of three years. A number of stations were established east of the Kuango, and, in consequence of prolonged stays at such stations, the new capital of the Muata Yamvo was reached in December, 1886, after two years of travel. The expedition was unable to proceed farther eastward, but it appears from the available reports that it succeeded in establishing Portuguese influence in the empire of the Muata Yamvo more securely. The expedition was probably undertaken on account of the encroachment of the Kongo Free State and the Germans upon that part of southern Africa which the Portuguese considered their property for a long while. The English are also endeavoring to establish their dominion in southern Africa as firmly as possible. A treaty has recently been made with the chief of Amatonga Land; and thus the whole coast of South Africa, from Orange River to Delagoa Bay, has become English.

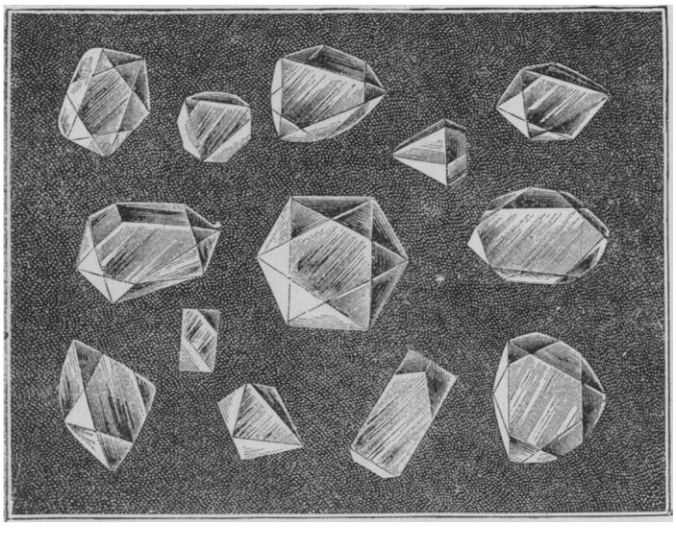
— The English are incessant in their endeavors to open a trade-route from India to China. One of the preliminary steps to reach this object is the establishment of a railroad from the valley of the Brahmaputra to the upper part of the Irawadi, by which means they expect to strengthen their position in Burmah. The region to be traversed is extremely mountainous, and the road will have to cross the Patkoï Mountains. Recently an expedition has been sent out to ascertain the feasibility of building the road, of which Messrs. Michell and Needham were in charge. They found that the Patkoï Range, which was formerly considered an insurmountable barrier for the trade between Assam and Burmah, can be crossed on a number of passes not exceeding 2,500 feet in height. They succeeded in crossing it on one of these passes with five elephants, and state that a road can be built without great difficulties. Thus the recent reports of Colqhoun and Woodthorpe are confirmed. At the present time the trade between China and Burmah is carried on by caravans consisting of from 200 to 2,000 animals, which cross the range during the dry season, i.e., between the months of November and May. They cross the territory of the Kachins, who exact heavy payments from them; nevertheless the caravans are subject to frequent attacks, and must be protected by an escort of armed men.

— In 1877 Fremy succeeded in obtaining very small crystals of artificial rubies. In 1887 he resumed his experiments, and, with the assistance of Mr. Verneuil, has succeeded in obtaining beautiful and comparatively large crystals. *La Nature* describes his experiments according to the report given to the Academy of Sciences of Paris, illustrated by cuts, which we reproduce here. On Feb. 27, Fremy and Verneuil presented to the academy these crystals, which were obtained by the action of fluorides upon aluminium. Fluoride of barium was made to act upon aluminium containing traces of bichromate of potassium. The regularity of crystallization, which was obtained after numerous experiments, was found to de-

pend principally upon the fire, which regulates and varies the chemical action. The crystals obtained in 1877 were laminated and friable. They were very thin, and embedded in a vitreous mass, which rendered it almost impossible to isolate them. Besides this, their chemical composition varied to a certain extent. By the new process they are easily separated from the porous matrix in which they are formed. The matrix is thrown into water, which is violently agitated. While the light matrix is broken and remains suspended, the rubies settle down on the bottom of the glass. They



are very clean, and it was found unnecessary to apply any acids for further cleansing. They are rhombohedral and exactly like natural rubies. Numerous analyses showed that they did not retain a trace of baryte, and that they were formed by pure aluminium colored by traces of chrome. The crystals are regular and of adamantine lustre. They are of perfect transparency, as hard as natural rubies, and cut topaz. Like the natural rubies, they turn black on being heated, but resume their color after getting cold



again. Having thus produced by synthesis rhombohedral crystals of rubies with all the physical and chemical properties of the most beautiful natural rubies, and forming them in a matrix which may be compared to that enclosing the natural mineral, Fremy and Verneuil believe they have definitely settled the question of the origin of rubies. So far, the experiments have been made with 50 grams of material only, and the crystals have therefore been comparatively small, not exceeding 0.02 of an inch in diameter. The authors, however, propose to continue their experiments on a larger scale, and expect to be able to make rubies of large dimensions.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Is the Rainfall increasing on the Plains?

IN connection with the recent discussion of the question of increasing rainfall west of the Mississippi River, I wish to call attention to some serious errors in the rainfall record at Fort Leavenworth, — a record fifty years in length, and therefore frequently quoted in support of the popular view. While examining these observations, I recently found that the precipitation for January, 1871, was given as 11.25 inches, — a most extraordinary amount. Suspecting such a result, I examined the files of the *Leavenworth Times*, and found that the precipitation for that month, as measured by Mr. F. Hawn, was 0.14 of an inch of rain, and 9.25 inches of *unmelted* snow. Unquestionably the Fort Leavenworth record is also mainly composed of unmelted snow. Further examination showed that the amounts recorded for the other winter months of 1871 and 1872 contained a similar error, and that consequently the total for 1872 should be 41.6 instead of 51.6, and for 1871 should probably not be greater that 35.5 instead of 56.75.

These latter values for the totals of those years are given in the 'Smithsonian Tables' and in the 'Reports of the Kansas Board of Agriculture,' and, so far as I know, have never been corrected by any one that has used these observations in discussing the question of a climatic change in rainfall.

If such errors as these exist in the records, it is not surprising to find that the rainfall of Kansas is increasing.

GEORGE E. CURTIS.

Topeka, Kan., April 10.

Scarlet-Fever.

I WOULD call attention to the fact that in many of the scarlet-fever reports published in your columns an assumption has crept in which seriously injures the value of the conclusions thus based.

All disease has a *first* case in any locality: *this* is the case only of real use to investigate scientifically. Other subsequent cases may or may not be due to the same cause as the first, or to contagion. To assume that a case, however closely following a first case, is due to contagion or infection from it, not allowing ample margin for other as yet unknown causes, is simply stupid, as it weakens arguments in a good cause and for the public good.

I had this winter a boy with his second genuine attack of scarlet-fever within six months. No cause of either attack was found. His brother and sisters did not suffer from contact with him, although it was attempted, of course, to isolate the patient. I myself caught the disease at about this time, but I am by no means willing to admit a belief that such disease came to me from contact with this or other patient. Many cases are known to me where exposure wholly failed to cause this disease, even in weak, poorly nourished individuals.

If any time is more dangerous than another in regard to liability to cause spreading of the disease, it would not be, according to my experience, that of the much talked and written of period of desquamation.

JOHN DIXWELL, M.D.

Boston, Mass., April 16.

Queries.

31. BLONDE AND BRUNETTE. — What is a blonde, and what is a brunette, and what is she who is neither of these? Definitions of the words I can find in a dictionary: they do not cover the ground. A woman with black or dark brown hair and eyes and a dark complexion is a brunette. But here is one with those eyes and hair and a very light complexion: she is not a pure brunette; what is she? A girl with light hair and eyes and a dark complexion is not a blonde; what is the name for her? What is she whose hair is almost black, complexion dark, but light-gray eyes? (By 'complexion' is meant the color of the skin of the face.)